

# EXHIBIT 1

## Comparative Digestive Physiology

### I. Anatomical classification

- A. Significance of fermentative digestion
  - 1. All mammals have some fermentative capacity
  - 2. Importance is directly related to fiber consumption
- B. Pregastric fermentors
  - 1. Importance of domestic ruminants in animal production
  - 2. Other well-known pregastric fermentors include macropod marsupials (e.g. kangaroo), hippopotamus and hamster
- C. Postgastric fermentors
  - 1. Cecal fermentors
    - 1. Mainly rodents and other small herbivores
    - 2. Often associated with coprophagy (feces eating)
  - 2. Colonic fermentors
    - 1. Includes true herbivores (e.g. horse), omnivores (e.g. pig, human) and carnivores (e.g. cat, dog)
    - 2. Degree of colonic sacculation is related to importance of fiber digestion and fermentative capacity

**NOTE:** The comparative importance of fermentation as a means of digestion can be related to the fraction of total digesta contained in fermentative compartments of the gastrointestinal tract.

### II. Adaptations to feed sources

- A. Prehension, mastication, deglutition
  - 1. Prehensile adaptations include forelimb (primates, raccoon), snout (elephant, tapir), tongue (anteater, cow) lips (horse, sheep).
  - 2. Masticatory adaptations include large canines and incisors (carnivores), specialized molars (herbivores), relative toothlessness of edentates (sloths, armadillos).
  - 3. Deglutition (swallowing) varies little with diet but quantity and composition of saliva varies considerably.
- B. Gastric capacity and structure
  - 1. Capacity is greatest in pregastric fermentors, stomachs act as reservoir
  - 2. Small stomachs in carnivores is related to high nutrient density of the diet
  - 3. Distribution and composition of epithelial lining varies between species and dietary adaptations
- C. Intestinal length and functions
  - 1. Small intestine
    - 1. Less variable between species than stomach and hind gut, but generally shorter in carnivores than in herbivores
  - 2. Large intestine
    - 1. Importance of hind gut fermentation dictates variation in structure and size
    - 2. Some hind gut fermentation occurs in most species [e.g. dog (carnivore), pig (omnivore) and pony (herbivore)]

### III. Fiber digestion - Ruminants vs Nonruminants

- 1. In general, pregastric fermentation increases the efficiency of fiber digestion. Larger nonruminants offset their lower digestive efficiency by eating and passing more; smaller nonruminants select more digestible forage components and/or practice coprophagy.